High-performance domain decomposition methods

Position: research engineer for two years

Context: domain decomposition methods (DDM) are, alongside multigrid methods, one of the dominant paradigms for defining efficient and robust preconditioners in modern large-scale applications dealing with partial differential equations and algebraic systems of equations. Though DDM are highly concurrent in nature and exhibit a workload which fits within the framework of distributed-memory parallel computing, special care must be taken when implementing such methods to fully leverage the efficiency of modern (pre-)exascale supercomputers. In particular, one must avoid unnecessary host-to-device copies when using GPUs, or perform batching to increase algorithmic throughput of sparse linear algebra kernels. As part of the PEPR NumPEx (numérique pour l'exascale), there is an open position for two years as a research engineer to investigate these issues in the context of the HPDDM library.

Activities: you will explore the use of accelerators such as NVIDIA and AMD GPUs to increase the throughput of current DDM algorithms, in particular by exploiting batching. You will validate your work on various applications from NumPEx partners, industrial, and international collaborators. The performance of your implementation will be evaluated on leading-edge supercomputers against state-of-the-art solvers with benchmarks from computational science and engineering, e.g., solid mechanics.

Skills: - experience programming in C or C++
- some knowledge of preconditioning linear systems of equations
- proficiency writing accelerator kernels (CUDA, HIP, or Kokkos) is not mandatory but highly valuable

Location: Sorbonne Université, LIP6, 4 place Jussieu, Paris

Desired level of education: M.Sc. or Ph.D. in applied mathematics, computer science, or a related field

Salary: function of the experience and based on Sorbonne Université grid

Expected start date: flexible

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